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**APPLICATION FOR DETERMINATION OF A
MODIFICATION UNDER 40 CFR 61 U.S.
DEPARTMENT OF ENERGY FEED MATERIALS
PRODUCTION CENTER ANALYTICAL FACILITY
UPGRADE**

11/27/90

**DOE-FMPC/USEPA
29
APPLICATION**

1207

APPLICATION FOR DETERMINATION
OF A MODIFICATION UNDER 40 CFR 61
U. S. DEPARTMENT OF ENERGY
FEED MATERIALS PRODUCTION CENTER

ANALYTICAL FACILITY UPGRADE

PLANT ADDRESS: FEED MATERIALS PRODUCTION CENTER
7400 WILLEY ROAD
FERNALD, OHIO 45030

OWNER ADDRESS: U. S. DEPARTMENT OF ENERGY
P. O. BOX 398705
CINCINNATI, OHIO 45239-8705

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Application for Determination of a Modification Under 40 CFR 61
U.S. Department of Energy - Feed Materials Production Center
Analytical Facility Upgrade- Building Number 15

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I. INTRODUCTION

This document is submitted as an Application for Determination of Modification under 40 CFR 61.06. The New Laboratory Facility is an expansion/renovation of the existing Laboratory Facility. The New Laboratory Facility will employ the best available technology for control of emissions and result in a net decrease of emissions from the facility. This application describes both the existing and new Laboratory Facilities, and will also compare the emissions of the existing Laboratory Facility with the expected emissions from the new facility. The Laboratory is located in the southwest corner of the FMPC. The location of Laboratory Facility within the FMPC complex is indicated in Figure 1. Figure 2 shows the existing facility layout. Figure 3 shows the scope of the expansion project, and the following sections describe the renovations.

II. DESCRIPTIONS

A. Existing Laboratory

The FMPC laboratory building was first occupied in October, 1952. Many deficiencies currently exist in this facility. These deficiencies include inadequate heating, cooling, and humidity control systems; clogged vacuum lines and frozen valves; and fume hoods which vent directly (unfiltered) into the environment. In order for the FMPC to maintain radiation exposures as low as reasonably achievable and assure compliance with other regulatory requirements, the Laboratory Facility will be expanded and renovated. Figure 2 shows the layout of the existing facility, the division between the controlled and uncontrolled sections, and the proliferation of emission points in the existing laboratory. Figure 4 shows the relationship of hoods to emission points in the laboratory building. Table 1 shows a comparison of the existing and expanded laboratory systems.

B. Expanded Laboratory

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The expansion of the Analytical Facility, Building 15, will consist of adding a two-story above grade wing to the north of the existing structure, increasing the present building size by approximately 28,200 finished square feet. Construction will be of block and concrete construction similar to the existing building. The exterior design/finish will be coordinated with the exterior of the renovated existing building. Exterior walls will be insulated on interior side of concrete masonry units. The expansion will include a dock area and a controlled side passenger/freight elevator to service the new building at the northwest building entrance. The expansion will house laboratory facilities and office areas which will allow for the renovation of laboratory facilities and office areas in the existing building. Existing exterior walls will also be insulated on interior side of concrete masonry unit. Existing spaces will be upgraded to provide more efficient laboratory facilities by improving emission controls, heating, ventilating, cooling, and humidity control systems, new plumbing and electrical fixtures, and new fume hoods. The existing fume hoods and HVAC system will be upgraded to current standards and operation. The renovated building will include an expanded dock area with a new dock ramp and a clean side passenger/freight elevator to service the renovated building at the southwest building entrance.

The expansion and renovation will be interfaced as required to provide a definitive clean/controlled separation. This will be accomplished through the use of air locks and the provision for changeout rooms and adjacent break rooms. The basement of the renovated building will house a photo studio, graphics, reproduction as well as an audio/visual center and a central mechanical room. The existing radiographic room will be renovated with a new access corridor constructed to the north corridor portion of the renovated building.

The expansion/renovation of the existing Analytical Facility will provide the necessary space required to accommodate the increased demand for lab services. It will also provide additional space for office, storage and support facilities. In addition to functional space requirements, the present facility is in a state of disrepair and renovation is required. The expansion and renovation would eliminate the present deficiencies and allow a more efficient and organized operation of the Analytical Facility. This expansion and renovation would also allow for a clean/controlled separation within the building.

Figure 3 shows the laboratory expansion, the controlled/uncontrolled division, and the planned emission points. Figure 4 shows hood/control device/emission point relationships.

C. Credible Abnormal Circumstance - Existing Laboratory

Since, historically, the existing laboratory hoods did not have control devices, the obvious credible abnormal circumstance was a spill of a 100% uranium bearing sample of a powder type material in a lab hood. In this case, it was assumed that 10% of the material that was spilled and exited the stack. This is a worst case assumption, since normally less than .1% is estimated to be lost. A large, 500 gram sample was assumed to have spilled and the resulting 50 grams of uranium was carried by the ventilation to the atmosphere. A credible abnormal circumstance of this type would result in an emission of 0.050 Kilogram uranium. This emission rate is also shown in Table 2.

D. Credible Abnormal Circumstance - Expansion Laboratory

Several abnormal circumstances were evaluated for possible impact on the environment in the expanded laboratory building. Since the hoods connected to the unmonitored stacks are all not expected to be significant contributors because of the very low concentrations of uranium in the samples, even a spill in one of the hoods would have insignificant emissions. All of the hoods that have analysis of higher concentrations of uranium or have the potential to emit radionuclides will be ducted through the HEPA filtration system before exhausting to the atmosphere. In the unlikely event of a fire or explosion in one of the perchloric hoods, the emissions to the atmosphere would be low because the samples have very low concentrations of radionuclides.

A spill inside a hood of a high concentration uranium sample at the same time as a HEPA filtration breach is not a very credible occurrence since a failure in the HEPA system would precipitate shutdown of the system through the monitoring systems alarm.

A breach of the HEPA filter system with a simultaneous failure of the monitoring equipment was chosen as the most credible abnormal occurrence for the renovated laboratory. Even though the filters are checked every hour, the system was assumed for this scenario to be breached for a total of two hours before noticeable soiling would show up on the sampler paper, initiating a shutdown. An abnormal circumstance such as this would emit to the atmosphere an additional 0.032 kilogram Uranium. As with the hourly and annual emissions, this total represents historical production oriented analysis of product streams instead of the expected environmental sampling. This also assumes a worst case scenario in which the production type sampling is doubled due to the increase in hoods capable of handling samples with significant uranium concentrations. This

emission rate, along with a comparison to the existing laboratory is shown in Table 2.

III. EMISSION COMPARISONS

A. Existing Lab Uranium Emissions

Emission estimates for the existing laboratory are based on the historical study of the FMPC emissions. The historical data accumulated was analyzed and an average emission rate per hood/year was established. The total estimate of 1.838 Kg/year is the average annual laboratory emission rate from all existing lab hoods. This is the best available estimate of emissions from the laboratory fume hoods. The method of calculation is discussed in the following paragraphs. Figure 2 shows the layout of the existing laboratory and the location of the existing stacks. Figure 4 has a flow diagram of the ventilation system.

Technical Laboratory personnel were contacted to evaluate the operations performed in their hoods, and from their knowledge of these operations, estimates were computed of what the emissions would be from each hood. This method of estimation was used due to the lack of any stack sampling data being available for any of the fume hoods on site.

Most analytical operations performed inside laboratory fume hoods require that the sample be preserved with little if any loss of sample material. Sixty-five existing hoods fall into this category. One gram was arbitrarily chosen as the amount of material emitted for these operations where uranium losses are not suspected. For the fourteen remaining the hoods, the estimates were calculated by determining the number of samples analyzed in a hood, the sample weight, percent uranium, and then estimating what percent of the sample was lost during the analysis. The fourteen significant hoods account for an average yearly rate

of 1.773 Kg uranium. Two HEPA Filters were added recently for a special project, but were used very little.

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The calculations were performed for active laboratories in both the laboratory building and the ES&H building by personnel experienced in the operation of the particular lab. The ES&H operations were recently moved to the lab building. The total emission from these laboratories during their 37 year history of operation averages 1.838 kilograms per year. Emissions that were reported as <1 gram U/year were estimated as 1 gram/year, which adds a conservative element to the estimate.

65 hoods at 1 gram U/yr =	.065 Kg U/yr
<u>14 hoods</u>	<u>= 1.773 Kg U/yr</u> (total of ave. yearly emissions)
79 Total Hoods	= 1.838 Kg U/yr

The estimate of 1.838 Kg U per year is used as the average estimated emissions for the laboratory sources. Since it would be impossible to estimate the number of hours of lab utilization that the 1.838 Kg covers, a standard average three shift operation of 6000 hours was used. The per hour emission rate is the average yearly rate divided by 6000 hours, and the maximum yearly rate is the per hour rate times 8760 hours/year. The calculations are shown in Appendix C.

The existing laboratory emissions are shown on the following page and in Table 2. The existing laboratory stack data is shown in Table 5.

EXISTING LABORATORY EMISSIONS

	<u>HOURLY</u>	<u>AVERAGE</u>	<u>MAXIMUM</u>
TOTAL EMISSIONS	3.06E-04 Kg U/Hr	1.838 Kg U/Yr	2.68 Kg U/Yr

B. Expanded Laboratory Uranium Emissions

Figure 3 shows the layout of the expanded laboratory and the locations of the emission points. Figure 4 is a flow diagram of the ventilation system.

The renovated and expanded laboratory estimate includes emission rates for all fume hoods and canopy hoods. Even though the operations performed in the lab are in transition from high uranium concentration production work to low uranium concentration environmental analysis, the higher historical figures were used to cover the remote possibility that production at the FMPC may resume. The laboratory expansion and renovation was initiated with the goal of minimizing emissions from the operations, and all existing operations were analyzed to determine control device requirements. All potentially significant radionuclide emitting operations were identified and HEPA filtration was designed to cover these areas. Additional HEPA filtered hoods were strategically placed throughout the lab building to be used for any new operations that were required. The number of hoods with HEPA filtration will increase from two recently installed in the existing lab to 31 available in the new lab.

The vast majority of existing laboratory emissions are from 14 hoods. Because there will be twice as many potentially significant hood sources (sources with HEPA filtration) in the new laboratory, the amount of uncontrolled emissions estimated for these sources was increased from 1.773 Kg/yr to 3.55 Kg/yr. This increase in uncontrolled emissions of 100% was estimated even

though the transition from production to environmental cleanup will reduce the probable emissions substantially. The new lab will reduce these emissions 1207 through the use of a HEPA filter (99.9% efficiency at 0.3 micron size). The average emissions from these operations will be reduced from 1.773 Kg U/yr in the existing laboratory to 3.55E-03 Kg U/yr with completion of the Laboratory Expansion project.

The other 0.065 Kg U/yr in existing laboratory emissions is from a total of 65 hoods that were estimated at <1 gram U/yr. Uranium losses for these hoods were not suspected because of the type of samples and the sampling methods involved, but a conservative estimate of 1 gram U/yr was included to represent worst case emissions. In the renovated and expanded laboratory building, there will be a total of 92 fume hoods and canopy hoods that are not controlled with the HEPA filter. Of these 92 sources, 80 are uncontrolled and 12 have perchloric scrubbers. One (1) gram U/yr was used for each of these insignificant sources for a total of 0.092 Kg U/yr.

92 hoods at 1 gram U/yr = .092 Kg U/yr

31 hoods = 3.55E-03 Kg U/yr (ave. yearly emissions times two)

123 Total Hoods = 0.096 Kg U/yr

The same calculations were performed to obtain emissions/hour and maximum emissions/year as was done in the existing summary. Total emissions are shown below and in Table 2. Calculations are shown in Appendix C. The Laboratory Upgrade emissions are shown on the following page and in Table 2. The existing Laboratory and Analytical Facility Upgrade stack data is shown in Table 5.

LABORATORY EXPANSION EMISSIONS

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	<u>EMISSIONS/ HOUR</u>	<u>AVERAGE EMISSIONS</u>	<u>MAXIMUM EMISSIONS</u>
TOTAL EMISSIONS	1.60E-05 Kg U/hr	0.096 Kg U/yr	0.140 Kg U/yr

C. Uranium Emission Reduction

The Laboratory Expansion Project will reduce emission rates by 94.8%. This estimated reduction is a worst case scenario which includes an unlikely doubling of uncontrolled emissions to a new control device (HEPA Filter). In reality, the transition from production to environmental remediation will greatly reduce the potential for radionuclide emissions. In addition, the major portion of the estimate is an accumulation of 92 fume hoods and canopy hoods that are not suspected to have radionuclide losses, but were estimated at 1 gram U/yr. The two stacks that exhaust these sources will be assigned a high priority for periodic sampling when the project is completed. A summary of the uranium emissions and comparisons follows and is shown in Table 2.

URANIUM EMISSION COMPARISON

	<u>EXISTING LABORATORY</u>	<u>RENOVATED LABORATORY</u>
TOTAL HOURLY EMISSIONS	3.06E-04 Kg U/hr	1.60E-05 Kg U/hr
TOTAL AVG. YEARLY EMISSIONS	1.838 Kg U/yr	0.096 Kg U/yr
TOTAL MAX. YEARLY EMISSIONS	2.68 Kg U/yr	0.140 Kg U/yr

Since the ratio of other radionuclides to the uranium will be the same in both cases, the uranium emissions are sufficient for comparing existing versus new. The radionuclide factors are shown in Table 3, and the complete list of maximum radionuclide emissions are shown in Table 4 for informational purposes.

D. Radionuclide Emission Data

The radionuclides identified and relative concentrations per kilogram of uranium are taken from analyses performed site wide. They are the compilation of sampling performed throughout the entire process area. The laboratory analyzes samples from the entire site, including residues, product streams, environmental samples, etc. Therefore, the site average radionuclide factors are the most accurate values to use for laboratory emissions. For the uranium isotopes, values corresponding to normal uranium (0.71% U-235) are used as an average enrichment of samples analyzed. These radionuclide factors and the lung solubilities are listed in Table 3.

The radionuclide factors are multiplied by the annual uranium emissions to arrive at the total radionuclide emissions from the laboratory. The same factors were used for both the existing and renovated lab emissions. Since the factors are the same and the uranium portion typically amounts to over 90% of the off-site dose, the uranium emission differential is sufficient for comparison purposes. For information purposes, a comparison of maximum annual emissions of all radionuclides and the resulting decrease is shown in Table 4.

IV. STARTUP OF EXPANDED LABORATORY

A. General Requirements

The Laboratory Expansion Phase of the project will be subject to startup activities, and will be evaluated by Operational Readiness Reviews. When the building expansion is accepted for occupancy, all facilities including hoods, HEPA filter, workstations, ventilation, etc. will be operational and functioning properly. At that time, all operations in the north hallway of the existing laboratory will transfer to the new laboratory facilities.

The vacated labs will not be used once the transfer is completed. The north hallway labs will become a construction zone for the next phase of the project. When the renovation of the north hallway is complete, all laboratories in the rest of the existing building will be vacated and moved to the new section. All fume hoods and canopy hoods outside the expansion project and north hallway will be removed in the next phase of the construction project which will concentrate on renovation of the rest of the existing laboratory building into office space.

Administrative controls will ensure that operations that may emit significant radionuclides are performed in HEPA filtered hoods. Continuous sampling and periodic sampling will be performed on the laboratory stacks as required. All existing hoods will cease operation when the new hoods become available.

The majority of the existing significant emitters are located in the north hallway section of the laboratory building and will be transferred to the new labs before the second phase of the construction. An immediate decrease in emissions will be accomplished because these significant emitters will be transferred to HEPA filtration hoods. Continuous monitoring will be operational from the start to verify the expected decrease.

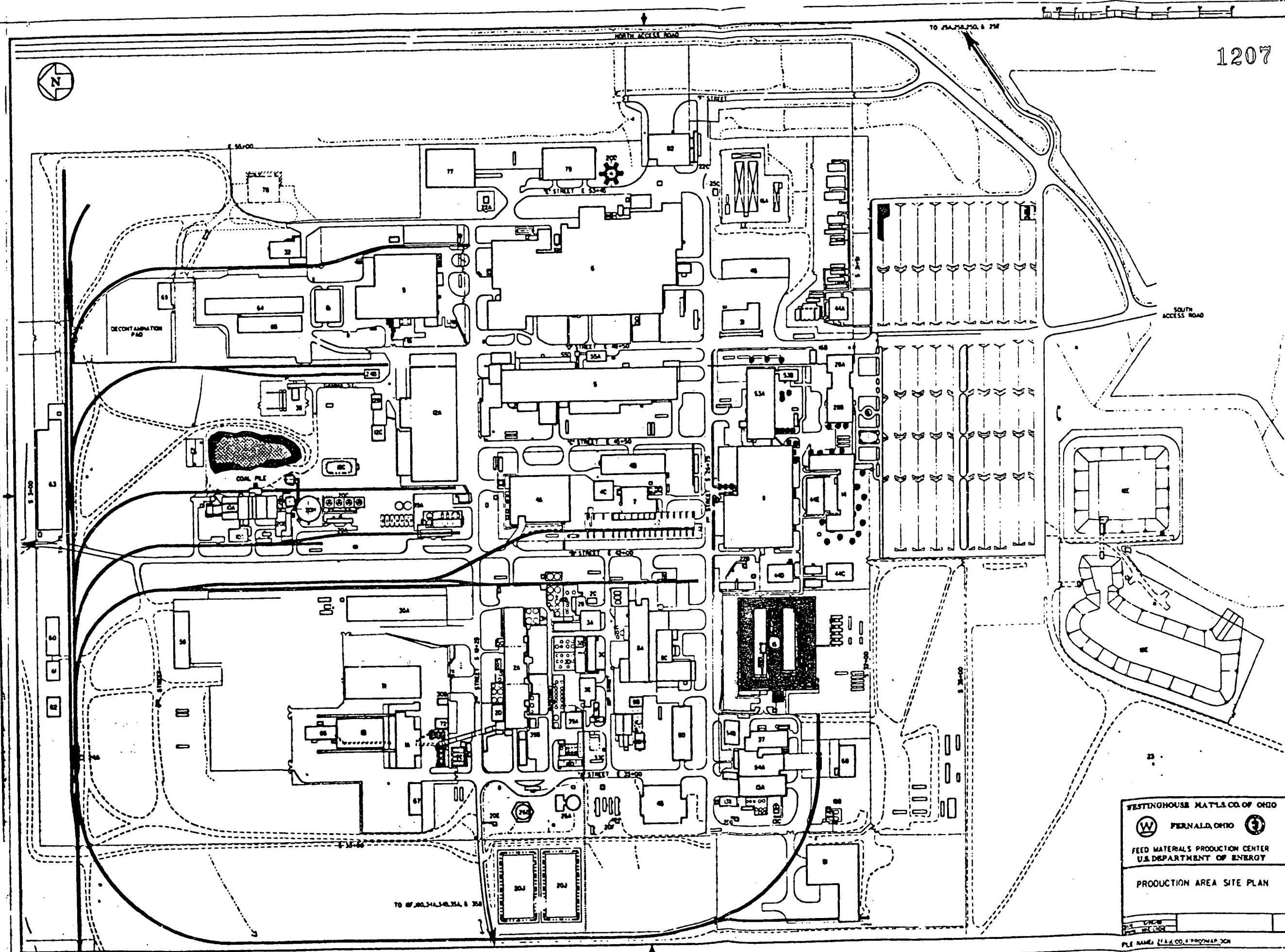
The north hallway operations cannot be operated simultaneously with the expansion hoods because of the transfer of operations and the changing of the north hallway to a construction zone.

B. Projected Schedule

This project is scheduled in several phases which allows portions of the new facility to be placed in service as they are completed. Total project completion is scheduled for May 1, 1992. The last phase of the project requires that the final existing laboratory elements be rendered inoperative on or before June 25, 1991.

APPENDIX A

FIGURES



FMPC BUILDING IDENTIFICATION	
10	GENERAL
11	PLANT 1 ON PLANT
12	PLANT 1 ON PLANT
13	ONE PLANT 1 ON PLANT
14	ONE PLANT 1 ON PLANT
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100	ONE PLANT 1 ON PLANT

WESTINGHOUSE MATERIALS CO. OF OHIO

PERNALL, OHIO

FEED MATERIALS PRODUCTION CENTER

U.S. DEPARTMENT OF ENERGY

PRODUCTION AREA SITE PLAN

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FIGURE 1
FMPC Site Map

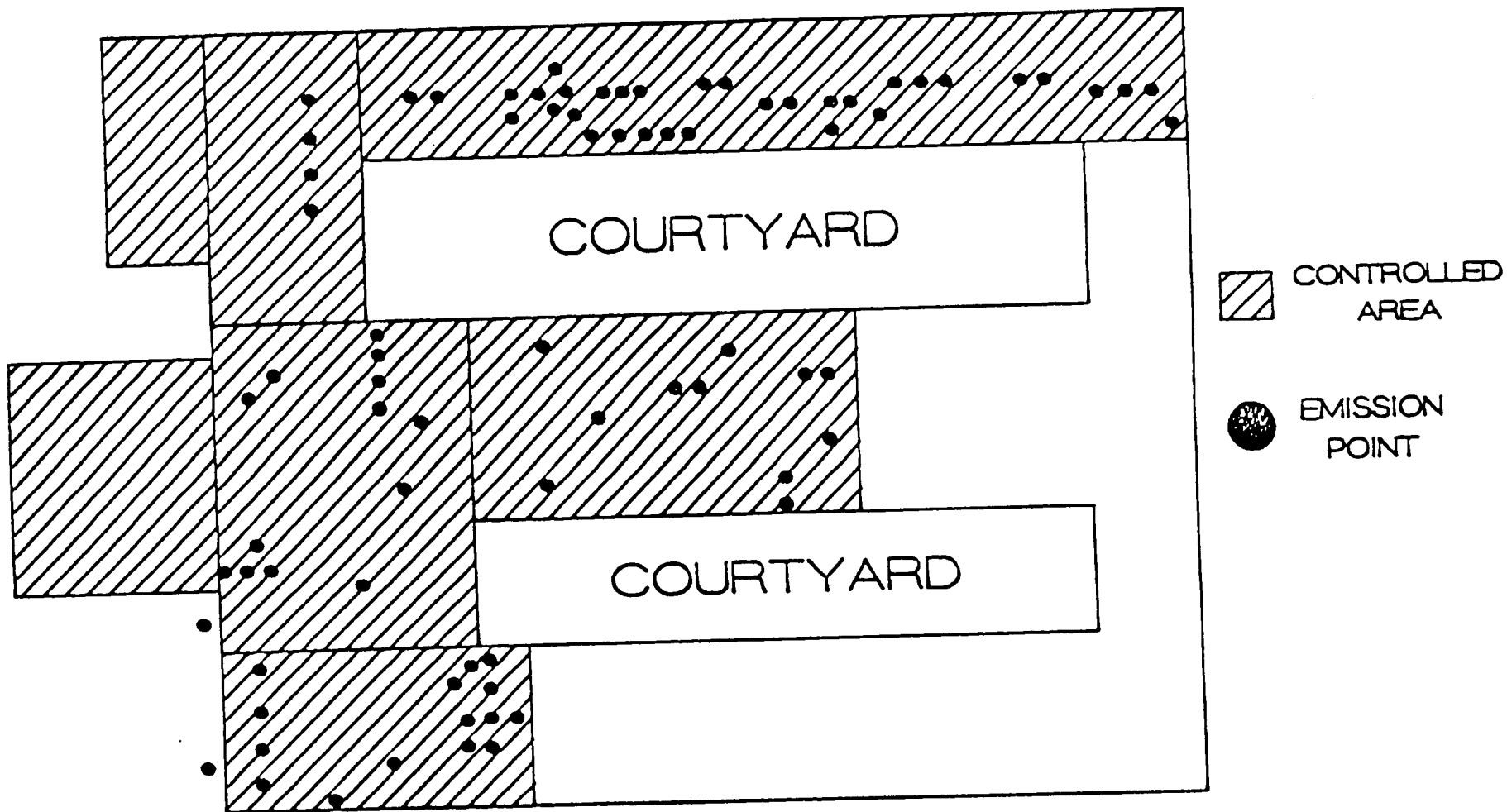
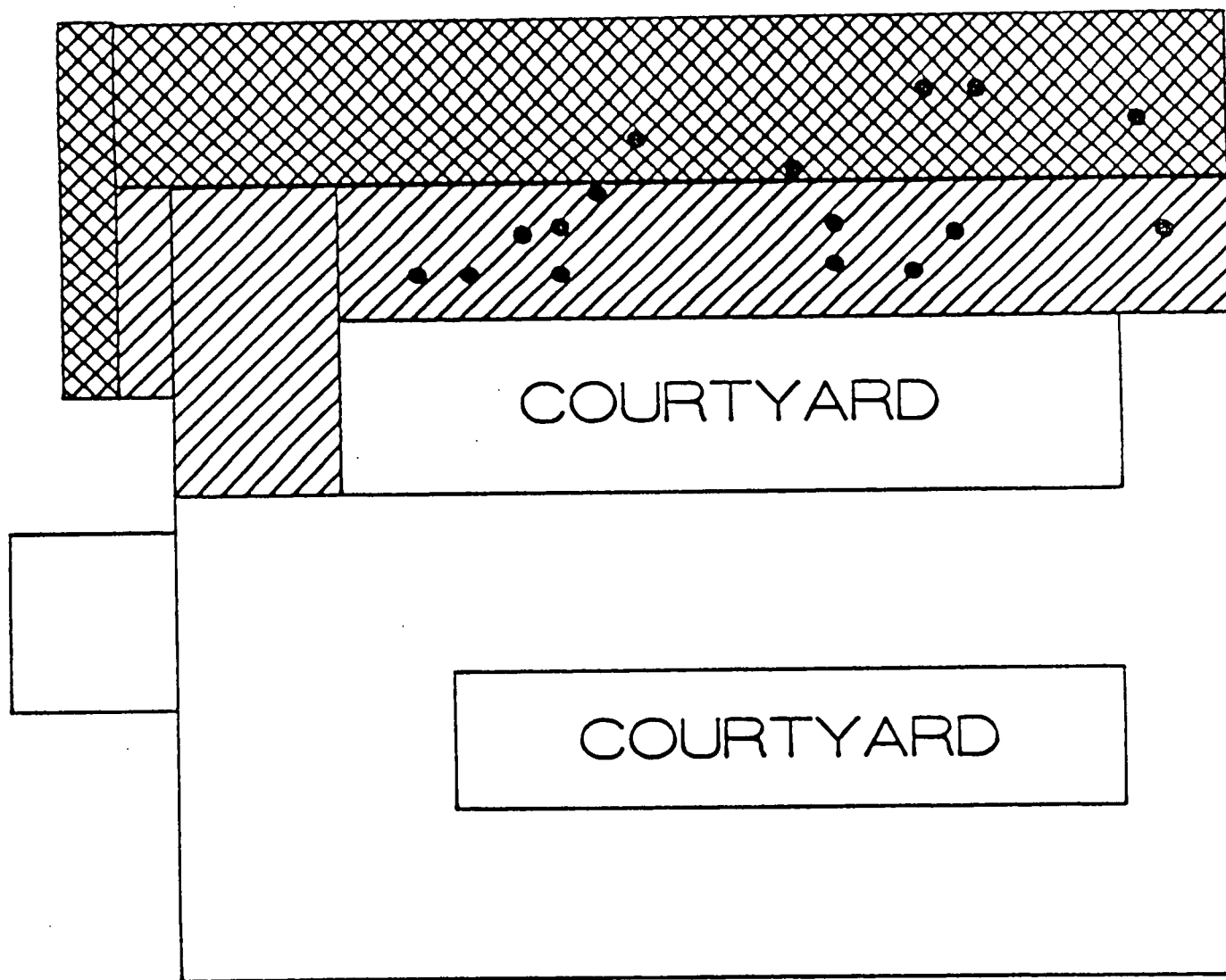


FIGURE 2
EXISTING LABORATORY PLAN AND STACKS






-  LABORATORY
TWO STORY
ADDITION
-  CONTROLLED
AREA
-  EMISSION
POINT

FIGURE 3
EXPANDED LABORATORY PLAN AND STACKS

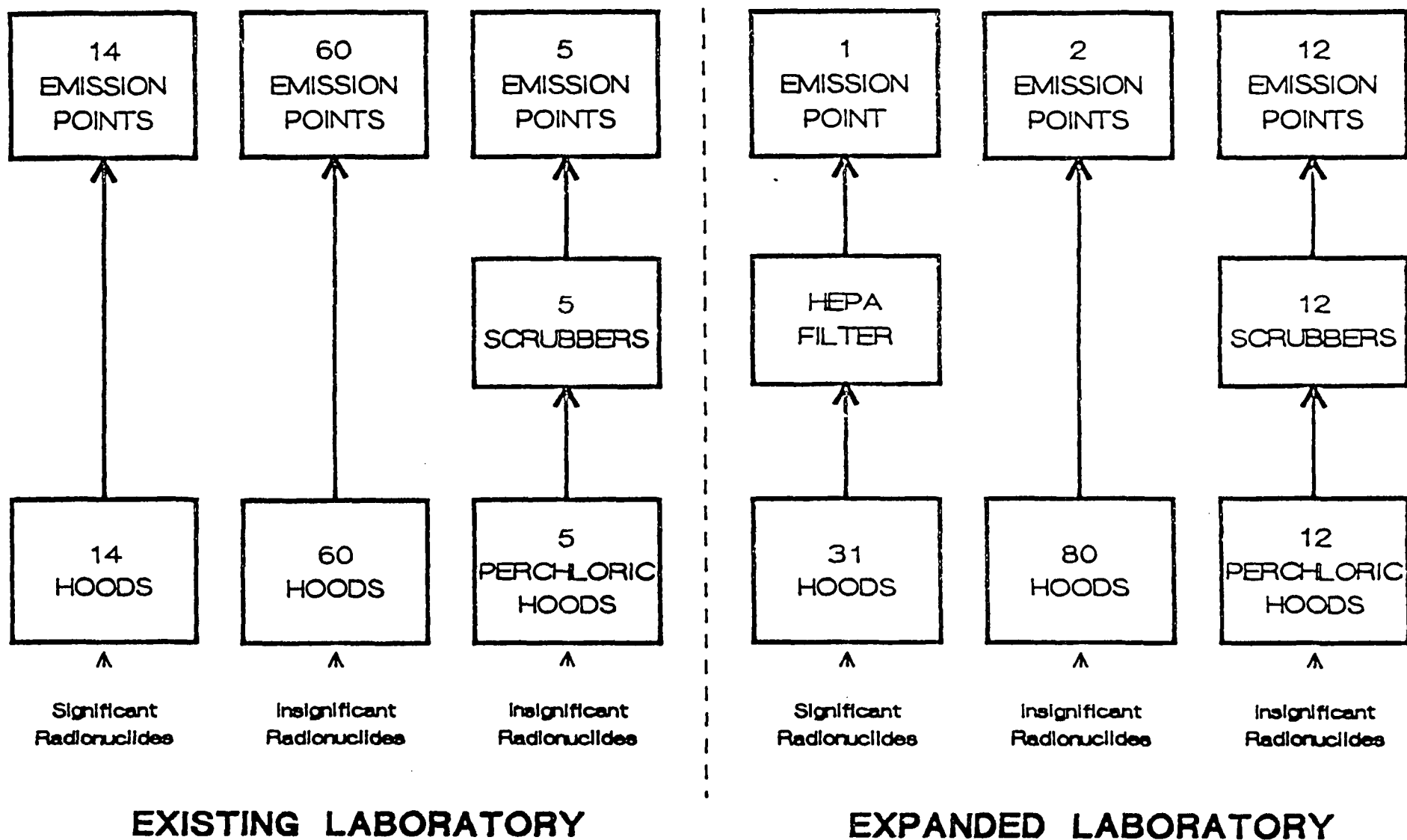


FIGURE 4
FLOW DIAGRAMS

APPENDIX B

TABLES

TABLE 1
SYSTEM COMPARISONS

	EXISTING LABORATORY	EXPANDED LABORATORY
Location	Building 15	Building 15
Number of Rooms	100 (approximately)	140 (Approximately)
Scope of Expansion	-	Additional 28,000 sq. ft.
Number of HEPA Filtered Hoods	2 (special application-little use)	31
Number of Perchloric Hoods	5	12
Number of Uncontrolled Hoods	72	80
Total Number of Hoods	79	123
Number of HEPA Filtered Stacks	2	1
Number of Perchloric Stacks	5	12 (Indiv. Stacks Req'd)
Number of Uncontrolled Stacks	72	2
Total Number of Stacks	79	15
Number of Continuously Monitored Stacks	0	1
Number of Stacks to be Periodically Monitored	14	2
Type of Monitor	None	Ludlum
Type of Sampler	None	Isokinetic Multipoint
Air Flow System	Individual (1 Hood Per Stack)	Variable Volume Exh Sys (Constant Face Velocity)
Facility Pressure Differential	Not Controlled	Controlled Differential

TABLE 2

URANIUM EMISSION DATA FOR NEW AND EXISTING LABORATORY FACILITY

	<u>Existing Facility</u>	<u>New Facility</u>	<u>Decrease</u>	<u>% of Decrease</u>
Average Hourly	3.06E-04 Kg U/hr	1.60E-05 Kg U/hr	2.90E-04 Kg U/hr	94.8%
Average Annual	1.838 Kg U/yr	0.096 Kg U/yr	1.742 Kg U/yr	94.8%
Maximum Annual	2.68 Kg U/yr	0.140 Kg U/yr	2.54 Kg U/yr	94.8%
Abnormal	0.050 Kg U/occ.	0.032 Kg/occ.	0.018 Kg/yr occ.	36%

TABLE 3
RADIONUCLIDE VALUES

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Radionuclides -----	Quantity (Ci/Kg U) -----	Solubility -----
U-234	3.42E-04	Y
U-235	1.53E-05	Y
U-236	3.18E-05	Y
U-238	3.32E-04	Y
Pu-239+240	4.39E-07	Y
Pu-238	9.06E-08	Y
Np-237	2.90E-07	Y
Th-234	1.54E-03	Y
Pa-234m	6.79E-04	Y
Th-232	1.49E-06	Y
Th-230	2.05E-05	Y
Th-228	2.14E-06	Y
Ra-228	2.43E-07	Y
Ra-226	1.36E-06	Y
Cs-137	1.13E-05	D
Ru-106	1.96E-06	W
Tc-99	4.83E-05	Y
Sr-90	1.49E-06	D
Ba-137m	1.13E-05	Y

TABLE 4

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MAXIMUM ANNUAL RADIONUCLIDE EMISSIONS

<u>RADIONUCLIDE</u>	<u>EXISTING SYSTEM Ci/yr</u>	<u>NEW SYSTEM Ci/yr</u>	<u>DECREASE Ci/yr</u>
U-234	9.17E-04	4.79E-05	8.69E-04
U-235	4.10E-05	2.14E-06	3.89E-05
U-236	8.52E-05	4.45E-06	8.08E-05
U-238	8.90E-04	4.64E-05	8.44E-04
Pu-239+240	1.18E-06	6.15E-08	1.12E-06
Pu-238	2.43E-07	1.27E-08	2.30E-07
Np-237	7.77E-07	4.06E-08	7.36E-07
Th-234	4.13E-03	2.16E-04	3.91E-03
Pa-234m	1.82E-03	9.51E-05	1.72E-03
Th-232	3.99E-06	2.09E-07	3.78E-06
Th-230	5.49E-05	2.87E-06	5.20E-05
Th-228	5.74E-06	3.00E-07	5.44E-06
Ra-228	6.51E-07	3.40E-08	6.17E-07
Ra-226	3.64E-06	1.90E-07	3.45E-06
Cs-137	3.03E-05	1.58E-06	2.87E-05
Ru-106	5.25E-06	2.74E-07	5.00E-06
Tc-99	1.29E-04	6.76E-06	1.22E-04
Sr-90	3.99E-06	2.09E-07	3.78E-06
Ba-137m	3.03E-05	1.58E-06	2.87E-05

Ci/Kg U (from Table 3) x Kg U (Emissions) = Ci/yr (Total Emissions)

TABLE 5
STACK DATA

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A.) Existing Laboratory Typical Stack

	<u>Types of Stacks</u>	<u>Diameter (meters)</u>	<u>Velocity (meters/sec)</u>	<u>Stack Height (meters)</u>
79 Stacks	Uncontrolled and Perchloric	.3	7.5	5.3

B.) Analytical Facility Upgrade

<u>Stack Number</u>	<u>Type of Stack</u>	<u>Diameter (meters)</u>	<u>Velocity (meters/sec)</u>	<u>Stack Height (meters)</u>
EF-1	Uncontrolled	1.32	17.22	16.79
EF-2	Uncontrolled	1.22	15.16	16.28
EF-3	HEPA	.91	17.24	14.76

Penthouse Perchloric Fume Hood Stacks

EF-6	Perchloric	.41	5.44	11.66
EF-7	Perchloric	.41	5.44	11.66
EF-8	Perchloric	.46	5.45	12.01

Other Perchloric Fume Hood Stacks

EF-4	Perchloric	.41	5.44	5.94
EF-5	Perchloric	.41	5.44	5.94
EF-9	Perchloric	.41	5.44	5.94
EF-10	Perchloric	.41	5.44	5.94
EF-11	Perchloric	.41	5.44	11.35
EF-12	Perchloric	.46	5.45	11.71
EF-13	Perchloric	.41	5.44	11.35
EF-14	Perchloric	.46	5.45	11.71
EF-15	Perchloric	.25	9.24	5.45

APPENDIX C
EMISSION CALCULATIONS

I. EXISTING LABORATORYA. Assumptions

1. The FMPC Historical Emissions Report was used for the existing laboratory emissions. These estimates have been used as the laboratory emission figures in the annual reports. The estimate is a compilation of estimated emissions over the 37 years of production converted to an average yearly rate.
2. The average annual rate was estimated to be produced in 6000 hours/year. The maximum rate is calculated at 8760 hours/year.
3. The hoods that were considered to be probable emitters, either due to the type of sample or the analysis method, were estimated using number of samples per year and loss per sample estimates.
4. The hoods that were not considered to be radionuclide emitters were estimated at < 1 gram/year. For conservative estimating purposes, these hoods were assumed to be emitting 1 gram/year.

B. Calculations

14	Hoods		=	1.773 Kg U/yr
65	Hoods	@ 1 gram/year	=	0.065 Kg U/yr
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79	Hoods		=	1.838 Kg U/yr

AVERAGE ANNUAL URANIUM EMISSIONS = 1.838 Kg U/YR

$$1.838 \text{ Kg U/yr} \div 6000 \text{ Hrs/yr} = 3.06\text{E-}04 \text{ Kg U/hr}$$

AVERAGE HOURLY URANIUM EMISSIONS = 3.06E-04 Kg U/HR

$$3.06\text{E-}04 \text{ Kg U/hr} \times 8760 \text{ Hrs/yr} = 2.68 \text{ Kg U/yr}$$

MAXIMUM ANNUAL URANIUM EMISSIONS = 2.68 Kg U/YR

II. EXPANDED LABORATORY

A. Assumptions

1. The existing uncontrolled emissions of 1.773 Kg U/yr was increased to 3.546 Kg U/yr for the expanded lab because the number of hoods designed for handling radionuclides (with a HEPA filter) increased to 31, even though production sampling is decreasing.
2. The HEPA filter efficiency was estimated at 99.9%.
3. The remaining hoods are estimated at < 1 gram/year. The calculation assumes a worst case of 1 gram/year for the remaining 92 hoods.
4. No credit is taken for the transition from production to environmental analysis, the cleaner laboratory environment, or the updating of scrubbers in the perchloric hoods.

B. Calculations

$$31 \text{ Hoods Uncontrolled} = 3.546 \text{ Kg U/yr}$$

$$31 \text{ Hoods w/HEPA Filters} = 3.55\text{E-}03 \text{ Kg U/yr}$$

$$92 \text{ Hoods @ 1 gram/year} = 0.092 \text{ Kg U/yr}$$

$$\begin{array}{r} \text{-----} \\ 123 \text{ Hoods} = 0.096 \text{ Kg U/yr} \end{array}$$

$$\text{AVERAGE ANNUAL URANIUM EMISSIONS} = 0.096 \text{ Kg U/YR}$$

$$0.096 \text{ Kg U/yr} \div 6000 \text{ Hrs/yr} = 1.60\text{E-}05 \text{ Kg U/hr}$$

$$\text{AVERAGE HOURLY URANIUM EMISSIONS} = 1.60\text{E-}05 \text{ Kg U/HR}$$

$$1.60\text{E-}05 \text{ Kg U/hr} \times 8760 \text{ Hrs/yr} = 0.140 \text{ Kg U/yr}$$

$$\text{MAXIMUM ANNUAL URANIUM EMISSIONS} = 0.140 \text{ Kg U/YR}$$